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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/613,738	07/03/2003	Alastair D. McAulay	1344-PA236	5644

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EXAMINER	
JUBA JR, JOHN	

ART UNIT	PAPER NUMBER
2872	

DATE MAILED: 09/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/613,738	MCAULAY, ALASTAIR D.	
	Examiner	Art Unit	
	John Juba, Jr.	2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 02 February 2004 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

Specification

The disclosure is objected to because of the following informalities. Appropriate correction is required:

There is no Brief Description of the Drawings.

Page 2, line 16, "one such single DOE algorithms" is not in noun-verb agreement.

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required:

There is no discussion of a first layer "formed with a phase mask *at a first angle*" or of a second layer "formed with a phase mask *at a second angle*" [emphasis added].

There is no discussion of "exposing said diffractive optic element to a light source" or of "computing the diffraction of said light source from said second layer". The expression "source" appears nowhere in the body of the specification. See claim rejections under 35 U.S.C. §112, second paragraph, below.

Claim Objections

Claim 1 is objected to because of the following informalities: In the seventh line, "computing the difrfraction of said light sourche" should read "computing the diffraction of said light source". Appropriate correction is required.

Claim Rejections - 35 USC § 112

Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 is confusing as to the statutory class of invention. It is not clear how a method can comprise a diffractive optical element. Methods comprise a series of active steps. Thus, it is not clear whether the claim encompasses a diffractive optical element made by the recited steps, or whether the claim encompasses only the steps leading to design/modeling/construction of the diffractive optical element.

Claim 1 is confusing as to the meaning of the expressions "first layer formed with a phase mask *at a first angle*" and "second layer formed with a phase mask *at a second angle*" [emphasis added]. Since there is no discussion of angles in the specification,

these expressions find no clear meaning. Further, it is believed that "phase mask" as used here, is a misnomer. Rather, it is believed that the claim should instead refer to the "phase screens" discussed in the specification. For the purposes of examination, the examiner has construed the expression "layer formed with a phase mask an a first [second] angle" as meaning "layer *comprising* a phase *screen disposed* at a first [second] angle", rather than as referring to oblique illumination of a phase mask, oblique deposition or oblique ion etching *through* a mask during "formation" of the layers.

Claim 1 is confusing or incorrect in reciting the step of "exposing said diffractive optic element to a light source" in combination with the step of "computing the diffraction". As far as the examiner understands, the step of "computing the diffraction" is performed after *modeling* the diffractive optic as at least two phase masks, and applying the model of an input wave field to the model of the diffractive optic element. There appears to be no actual construction of the diffractive element until after several iterations of the design algorithm. Thus, the computation of diffracted light is not performed by actually passing light from a source through the element.

Without attempting to distinguish over the prior art, the examiner would characterize the method as

a method of optimizing phase masking in a diffractive optic element system, the method comprising the steps of:

specifying a desired field distribution in a predetermined plane from said system;

modeling at least one diffractive optic of said system as comprising at least a first layer and a second layer, wherein said first layer is represented

as a phase screen disposed in the system at a first angle, and said second layers is represented as a phase screen disposed in the system at a second angle;

specifying an intended input to said optical system and mathematically modeling said input as a propagating intensity and phase distribution;

mathematically applying said input to said at least first and second layer;

computing the diffracted field distribution propagating from said second layer in response to said input;

analyzing the field distribution at said predetermined plane that results from said diffracted field distribution;

comparing analyzed field distribution to the desired field distribution to define an error value as the difference between the analyzed and desired field distributions;

determining if said the error value is within a desired range;

considering the diffractive optic model to be optimized when said error value is within said desired range; and

when said error value is not within said desired range, iteratively modifying at least one of said phase screens and performing said applying, computing, analyzing, comparing, and determining steps until said error value is within the desired range, so as to arrive at an optimized model of said at least one diffractive optic.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Glytsis and Gaylord (*JOSA A* 4(11)). Referring *initially* to the discussion of Figure 1, Glytsis and Gaylord disclose a method of characterizing phase masking in a diffractive optic element system, comprising:

[providing] a diffractive optic element having a first layer S_1 and a second layer S_N, wherein said first layer is formed with a phase mask at a first angle and the second layer is formed with a phase mask at a second angle;

exposing said diffractive optic element to [light $\mathbf{k}_1$ from] a light source;

computing the diffraction (diffraction efficiency) of said [light from said] light source spreading from said second layer (see for example, Table 1); and

analyzing said computed diffraction (diffraction efficiency) from said second layer and comparing said computed diffraction to a predetermined error value. In Table 1, the "Individual Grating Analysis" product may be considered as "predetermined error value". Further, the "Discussion and Summary" section discloses a step of analyzing the computed diffraction in terms of the deviation of the sum of diffraction efficiencies (calculated orders) from unity. Glytsis and Gaylord identify a diffraction efficiency convergence "to within 10^{-8} to 10^{-6}". This level of accuracy is compared to "that needed for practical applications." Thus, the level of accuracy actually needed for practical applications can be regarded as the "predetermined error value" to which the diffraction efficiency convergence "to within 10^{-8} to 10^{-6}" has been compared. The preambular

characterization of the method as a "method of optimizing" does not distinguish the claimed method over the method of the prior art, since the prior art discloses every positively recited step of the method. For example, the expression "optimizing" does not lend any particular meaning to the step of "comparing", since the step of comparing is not expressly related to determination of an endpoint.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Niu, et al (U.S. Patent Appl. Pub. No. 2001/0051856 A1), in view of Official notice. Niu, et al disclose a method of characterizing the function of a diffractive optic element comprising modeling the diffractive optic element as at least first and second phase mask layers, mathematically exposing the diffractive optic to an incoming light wave, and computing the diffraction of the light from the second layer. Niu, et al suggest the method as a means to determine the grating profile corresponding to a measured diffraction spectrum (paras. [0158] and [0170]). Thus, Niu, et al at least suggest the steps of analyzing the computed diffraction pattern and comparing the computed value *to a predetermined value.* Thus, Niu, et al disclose the invention substantially as claimed.

However, Niu, et al do not expressly disclose the step of comparing the computed diffraction to a predetermined "error value", as recited.

The examiner takes Official notice of the fact that it was well known in the art of mathematically modeling systems, to perform comparisons between an actual (or desired) value and a computed value and further to compare the computed value to a predetermined error value. Comparison to a predetermined error value was known to provide an assessment as to the accuracy or "fit" of the computed value to the actual or desired value. The assessment was known for use in determining an endpoint of the modeling stage.

It would have been obvious to one of ordinary skill to compare the computed diffraction of Niu, et al to a predetermined error value, in the interest of providing an assessment as to the fit of the "modeled" diffractive structure to an actual diffractive structure that produced the measured diffraction spectrum. Such an assessment would have provided the rather obvious advantage of alerting the artisan of a suitable endpoint of the calculation.

Conclusion

The prior art made of record and not relied upon is considered pertinent to Applicant's disclosure.

Johnson, et al (U.S. Patent Appl. Pub. No. 2002/0038196 A1) disclose a method of characterizing the diffraction of light from a multilayered diffractive structure

comprising the step of defining a composite scattering matrix as the aggregate of the *complex* scattering matrices of the individual layers.

M.G. Moharam, et al (*JOSA A*) disclose a method of diffraction analysis for multilayered diffractive elements.

N. Lindlein, et al (*JOSA A*) disclose a method of ray tracing through optical systems having diffractive optics, the method accounting for the phase function of each diffractive optic.

Lifeng Li (*JOSA A*) discloses a method of characterizing diffractive optic element by modeling the element as a plurality of phase masks.

Soon Ting Han, et al (*Appl. Optics*) disclose a reverse integration method of performing rigorous coupled-wave analysis of diffractive optic structures modeled as multiple phase masks.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Juba whose telephone number is (571) 272-2314. The examiner can normally be reached on Mon.-Fri. 9 - 5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Drew Dunn whose number is (571) 272-2312 and who can be reached on Mon.- Thu., 9 – 5.

The centralized fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306 for *all* communications.

JOHN JUBA, JR.
PRIMARY EXAMINER
Art Unit 2872

September 16, 2004